Archaeological Services
University of Durham

Hatcliffe-Nettleton Project, North East Lincolnshire

geophysical survey

on behalf of
Dr Steven Willis
University of Kent

Report 1726
September 2007

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Contents

1. Summary

The project

1.1 This report presents the results of geophysical survey conducted on land near Hatcliffe Top Farm, Hatcliffe, North East Lincolnshire. The works comprised a fluxgate gradiometer survey totalling approximately 2.2ha.

1.2 The works were undertaken on behalf of Dr Steven Willis of the University of Kent.

Results

1.3 The survey has revealed a complex of soil-filled ditches and enclosures, almost certainly reflecting more than one phase of activity.

1.4 These archaeological features appear to continue beyond the limit of the survey in every direction suggesting the extent of the settlement has not yet been determined.

1.5 Remains of medieval ridge and furrow cultivation have also been detected.

2. Project background

Location (Figure 1)

2.1 The study area is located on agricultural land north of Hatcliffe Top Farm, Hatcliffe, North East Lincolnshire (NGR: TA 2295 0215). The field is bounded by another arable field to the south, a line of trees to the west, the Hatcliffe road to the north and the A18 Barton Street to the east. The area surveyed measured approximately 2.2ha.

Objective

2.2 The principal objective of the survey was to assess the nature and extent of any sub-surface features of potential archaeological significance as part of an ongoing survey and excavation project examining the settlement and economy of the Lincolnshire Wolds during later prehistory and the Roman period.

Methods statement

2.3 The survey was undertaken in accordance with instructions provided by Dr Willis.

Dates

2.4 Fieldwork was undertaken on 31st August 2007. This report was prepared between 4th and 14th September 2007.

Personnel

2.5 Fieldwork was conducted by Lorne Elliott (Supervisor) and Natalie Swann. This report was prepared by Lorne Elliott, with illustrations by Ed Davies, and edited by Duncan Hale, the Project Manager.

Archive/OASIS

2.6 The site code is **HNP07**, for **H**atcliffe-**N**ettleton **P**roject 20**07**. The survey archive will be supplied on CD to Dr Willis for deposition with the project archive. Archaeological Services is registered with the **O**nline **A**cces**S** to the **I**ndex of archaeological investigation**S** project (OASIS). The OASIS ID number for this project is **archaeol3-31161**.

3. Archaeological and historical background

3.1 The Hatcliffe-Nettleton Project has demonstrated that this comparatively under-examined area of the Lincolnshire Wolds has a well-preserved and richly informative archaeological record. Fieldwalking has identified and characterized a series of sites, whilst excavations have explored a Roman roadside settlement with a series of major stone buildings.

3.2 Fieldwalking and excavations within the survey area have identified features containing artefacts from the Roman and Anglo-Saxon periods.

3.3 Aerial photographs have identified possible archaeological features in the south-western corner of the study area.

4. Landuse, topography and geology

4.1 At the time of survey the study area comprised one field of recently ploughed agricultural land.

4.2 The survey area was predominantly level at a mean elevation of *c*.50m OD, sloping gently down to the north and north-east.

4.3 The underlying solid geology of the area comprises chalk, which is overlain by boulder clay and morainic drift.

5. Geophysical survey

Standards

5.1 The surveys and reporting were conducted in accordance with English Heritage Research and Professional Services Guideline No.1, *Geophysical survey in archaeological field evaluation* (David 1995); the Institute of Field Archaeologists Technical Paper No.6, *The use of geophysical techniques in archaeological evaluations* (Gaffney, Gater & Ovenden 2002); and the Archaeology Data Service *Geophysical Data in Archaeology: A Guide to Good Practice* (Schmidt 2001).

Technique selection

5.2 Geophysical surveying enables the relatively rapid and non-invasive identification of potential archaeological features within landscapes and can involve a variety of complementary techniques such as magnetometry, electrical resistance, ground-penetrating radar and electromagnetic survey. Some techniques are more suitable than others in particular situations, depending on a variety of site-specific factors including the nature of likely targets; depth of likely targets; ground conditions; proximity of buildings, fences or services and the local geology and drift.

5.3 In this instance, it was considered likely that cut features, such as ditches and pits, might be present on the site, and that other types of feature such as trackways, wall foundations and fired structures (for example kilns and hearths) might also be present.

5.4 Given the anticipated shallowness of targets and the non-igneous geological environment of the study area a geomagnetic technique, fluxgate gradiometry, was considered appropriate for detecting each of the types of feature mentioned above. This technique involves the use of hand-held magnetometers to detect and record minute anomalies in the vertical component of the Earth's magnetic field caused by variations in soil magnetic susceptibility or permanent magnetisation; such anomalies can reflect archaeological features.

Field methods

5.5 The survey comprised one area located around an excavation trench (Figure 2).

5.6 A 30m grid was established across the survey area and tied-in to known, mapped Ordnance Survey points using a Trimble Pathfinder Pro XRS global positioning system (GPS) with subsequent RINEX calibration.

5.7 Measurements of vertical geomagnetic field gradient were determined using a Bartington Grad601-2 dual fluxgate gradiometer. A zig-zag traverse scheme was employed and data were logged in 30m grid units. The instrument sensitivity was set to 0.1nT, the sample interval to 0.25m and the traverse interval to 1.0m, thus providing 3600 sample measurements per 30m grid unit.

5.8 Data were downloaded on-site into a laptop computer for initial processing and storage and subsequently transferred to a desktop computer for processing, interpretation and archiving.

Data processing

5.9 Geoplot v.3 software was used to process the geophysical data and to produce both a continuous tone greyscale image and a trace plot of the raw (unfiltered) data. The greyscale and interpretations are presented in Figures 2-4; a trace plot is provided in Appendix I. In the greyscale image, positive magnetic anomalies are displayed as dark grey and negative magnetic anomalies as light grey. A palette bar relates the greyscale intensities to anomaly values in nanoTesla.

5.10 The following basic processing functions have been applied to the data:

clip	clips, or limits data to specified maximum or minimum values; to eliminate large noise spikes; also generally makes statistical calculations more realistic.
zero mean grid	sets the background mean of each grid to zero; for removing grid edge discontinuities.
zero mean traverse	sets the background mean of each traverse within a grid to zero; for removing striping effects in the traverse direction and removing grid edge discontinuities.
destagger	corrects for displacement of anomalies caused by alternate zig-zag traverses.
despike	locates and suppresses random iron spikes in gradiometer data.
interpolate	increases the number of data points in a survey to match sample and traverse intervals. In this instance the data have been interpolated to 0.25 x 0.25m intervals.

Interpretation: anomaly types

5.11 A colour-coded geophysical interpretation plan is provided. Three types of geomagnetic anomaly have been distinguished in the data:

positive magnetic	regions of anomalously high or positive magnetic field gradient, which may be associated with high magnetic

susceptibility soil-filled structures such as pits and ditches.

negative magnetic — regions of anomalously low or negative magnetic field gradient, which may correspond to features of low magnetic susceptibility such as wall footings and other concentrations of sedimentary rock or voids.

dipolar magnetic — paired positive-negative magnetic anomalies, which typically reflect ferrous or fired materials (including fences and service pipes) and/or fired structures such as kilns or hearths.

Interpretation: features

5.12 A colour-coded archaeological interpretation plan is provided. Except where stated otherwise in the text below, positive magnetic anomalies are taken to reflect relatively high magnetic susceptibility materials, typically sediments in cut archaeological features (such as furrows, ditches or pits) whose magnetic susceptibility has been enhanced by decomposed organic matter and/or by burning.

5.13 The survey has recorded a complex of predominantly rectilinear, curvilinear and discrete positive magnetic anomalies throughout the area. These anomalies appear to continue beyond the limit of the survey in every direction. The majority of these anomalies almost certainly reflect soil-filled ditches, which here define enclosures and trackways, and appear to represent more than one phase of activity.

5.14 In the northern part of the survey these enclosures typically measure 20-30m square with a principal axis aligned roughly north-south along a ridge of land parallel to the A18.

5.15 Several positive magnetic anomalies detected in the south-western corner of the survey appear to correspond to features recorded on aerial photographs. The most prominent anomaly here represents a curvilinear enclosure measuring roughly 60m by 40m.

5.16 The negative magnetic anomaly measuring roughly 3m by 15m in the northern-central part of the survey corresponds to an open excavation trench.

5.17 A series of parallel weak positive magnetic anomalies oriented broadly north-south has been detected throughout the area, almost certainly reflecting former ridge and furrow cultivation.

5.18 The present plough regime has been detected as a series of very weak parallel negative and positive magnetic anomalies with a broadly east-west alignment.

5.19 A chain of intense dipolar magnetic anomalies aligned broadly north-south in the south-western part of the field almost certainly reflects a ferrous service pipe.

5.20 A weak negative magnetic anomaly also aligned broadly north-south along the south-western edge of the survey area reflects a change in land use.

5.21 A scatter of small, discrete dipolar magnetic anomalies was detected across the survey area. These anomalies almost certainly reflect items of near-surface ferrous and/or fired debris, such as horseshoes and brick fragments, and often have little or no archaeological significance. A representative sample of these anomalies is presented in the geophysical interpretation drawing, though for clarity they have not been included in the archaeological interpretation drawing.

6. Conclusions

6.1 Fluxgate gradiometer survey has been undertaken as part of an ongoing survey and excavation project examining the settlement and economy of the Lincolnshire Wolds during later prehistory and the Roman period.

6.2 The survey has revealed a complex of ditched enclosures and trackways, almost certainly reflecting more than one phase of activity.

6.3 These archaeological features appear to continue beyond the limit of the survey in every direction suggesting the extent of the settlement has not yet been determined.

6.4 Remains of medieval ridge and furrow cultivation have also been detected.

7. Sources

David, A, 1995 *Geophysical survey in archaeological field evaluation,* Research and Professional Services Guideline **1**, English Heritage

Gaffney, C, Gater, J, & Ovenden, S, 2002 *The use of geophysical techniques in archaeological evaluations*, Technical Paper **6**, Institute of Field Archaeologists

Schmidt, A, 2001 *Geophysical Data in Archaeology: A Guide to Good Practice*, Archaeology Data Service, Arts and Humanities Data Service

Appendix I: Trace plot of geophysical data

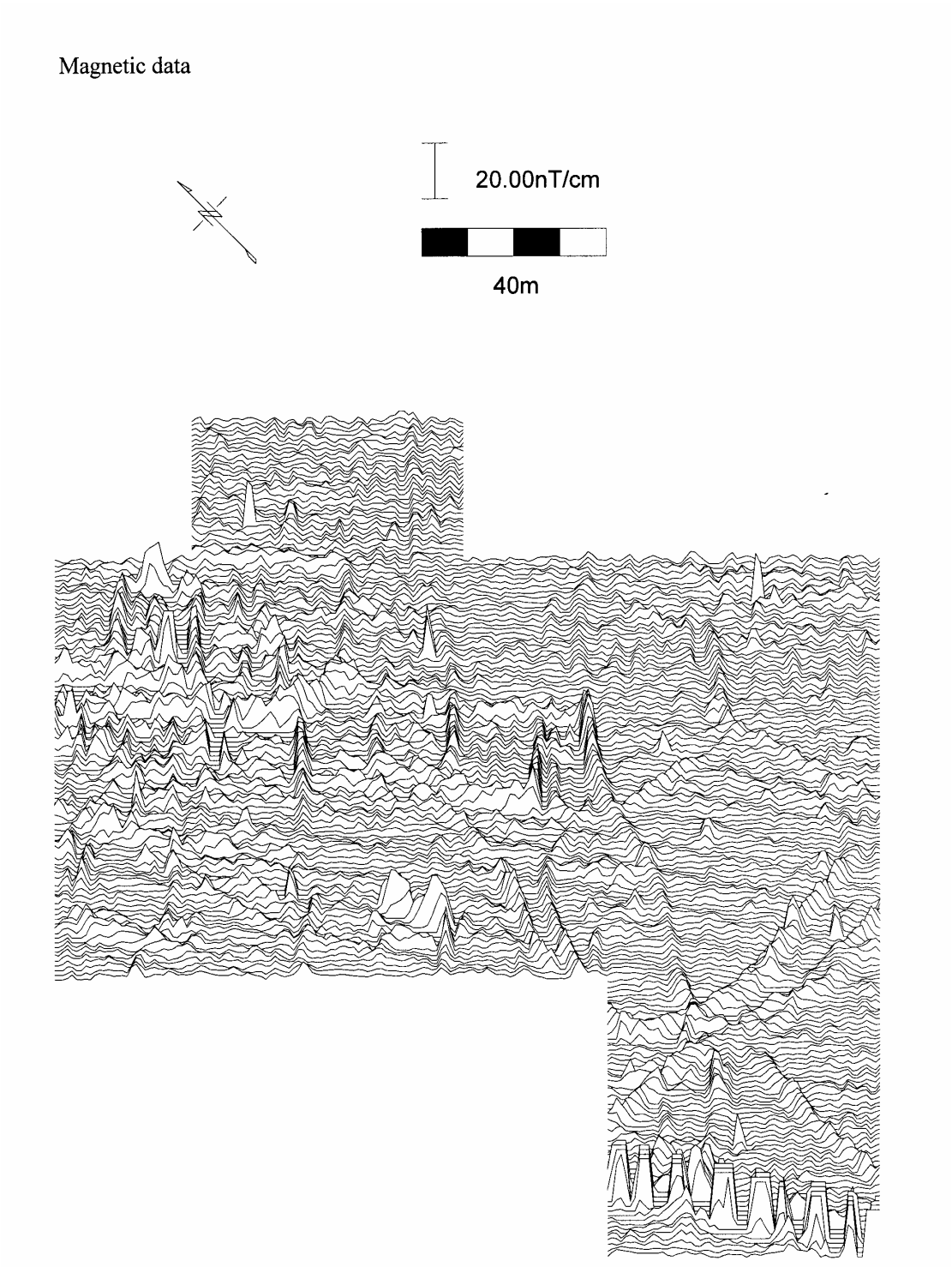

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Figure 1
Location of survey area

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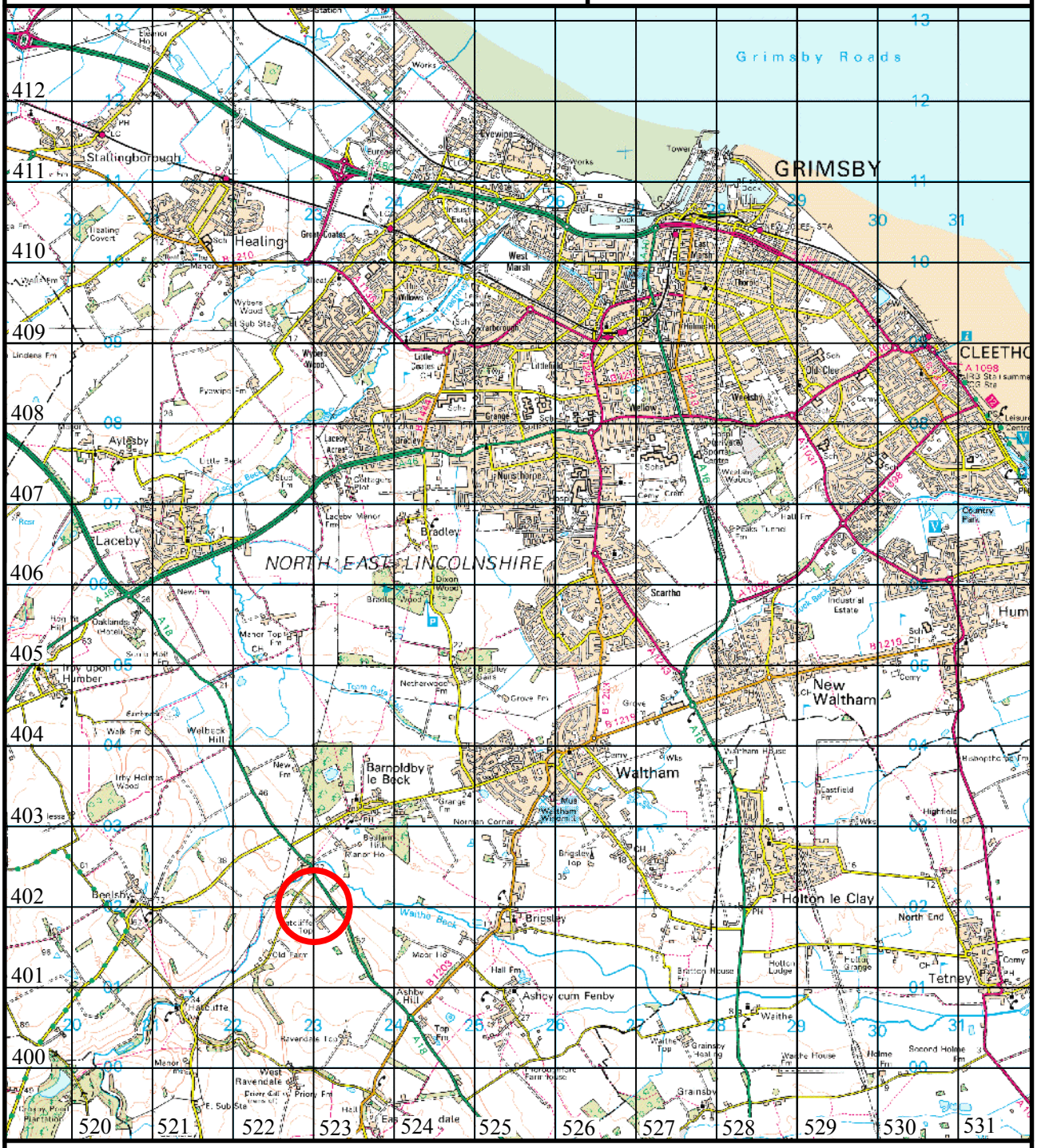

location of survey area

0 3km

scale 1:75 000 - for A4 plot

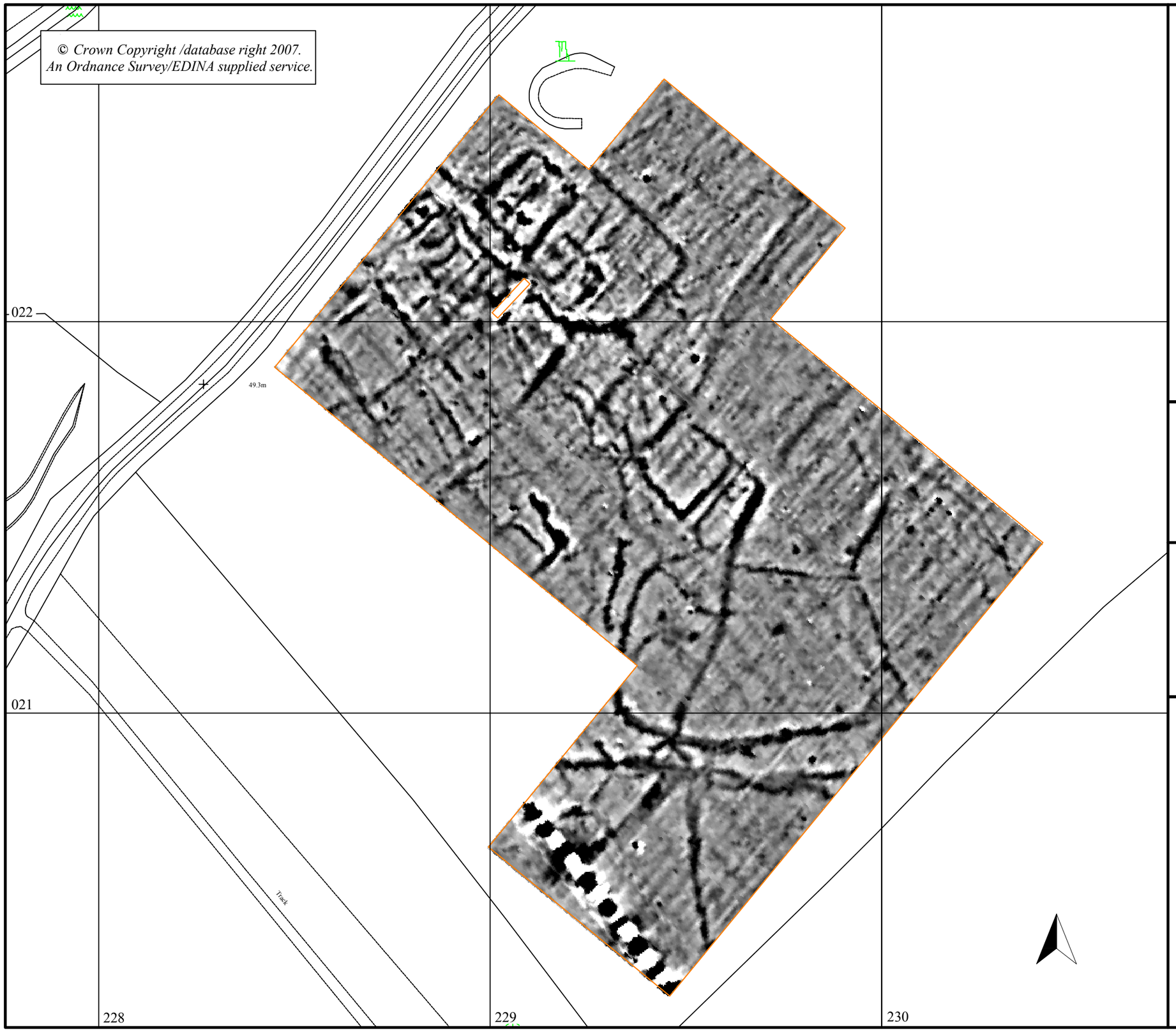

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Figure 2

Geophysical survey

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0 50m

scale 1:1000 - for A3 plot

outline of survey area

4.00
3.33
2.67
2.00
1.33
0.67
0.00
-0.67
-1.33
-2.00
-2.67
-3.33
-4.00 nT

022

49.3m

021

228

229

230

Track

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Figure 3

Geophysical interpretation

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0 50m

scale 1:1000 - for A3 plot

outline of survey area

positive magnetic anomalies

negative magnetic anomalies

dipolar magnetic anomalies

022

49.3m

021

228

229

230

Track

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Figure 4

Archaeological interpretation

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0 50m

scale 1:1000 - for A3 plot

outline of survey area

soil-filled features

service pipes

orientation of ridge and furrow

2007 excavation